



UNIVERSITI PUTRA MALAYSIA

**SMARTCARD AS APAYMENT ALTERNATIVE:
A DIFFUSION OF INNOVATION PERSPECTIVE**

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**SMARTCARD AS A PAYMENT ALTERNATIVE:
A DIFFUSION OF INNOVATION PERSPECTIVE**

By

TINA YUSMAN

**Thesis Submitted in Partial Fulfillment of the Requirement for the
Degree of Master of Science in the Graduate School of Management
Universiti Putra Malaysia**

June 2002



If a man is to be called a street sweeper, he should sweep streets even as Michelangelo painted, or Beethoven composed music. Or Shakespeare wrote poetry. He should sweep streets so well that all the hosts of heaven and earth will pause to say, here lived a great street sweeper who did his job well.

Martin Luther King, Jr

To my loved ones, rest assured that I have tried my best.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in partial fulfillment of the requirement for the degree of Master of Science

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June 2002

Chairman: Associate Professor Dr. Samsinar Md. Sidin

Faculty: Faculty of Economics and Management

The main principal of the study is to determine the perception of innovation characteristics and see whether they differ between adopters and non-adopters of SmartCard. SmartCard was chosen in this study mainly because of its newness and the importance of such innovation be studied. Due to this, innovativeness was also chosen to be a part of this study. Innovativeness was measured using the Domain Specific Innovativeness Scale by Goldsmith and Hofacker (1991) for its sound psychometric values. Innovation characteristics on the other hand were measured using 11-item measurement proposed by Rogers (1983).

Cronbach's alpha showed a value of 0.7337 with Kaiser-Meyer-Olkin Measure of Sample adequacy revealed a value of 0.725. The result of the study revealed that, using ANOVA, demographic variables such as race and age have an impact on innovativeness which give rise to the fact that culture, nationalism and emotions does

affect innovativeness than the more tangible values. Difference in innovativeness was also detected between the adopters and non-adopters with the adopter of SmartCard being more innovative. Wilk's Lambda showed a value of 0.861. Innovativeness was also found to be correlated with innovation characteristics, which means that how a person perceives an innovation depends on how innovative a person is. Lastly using Discriminant analysis, it was discovered that there are significant differences in the perception between both adopters and non-adopters with Wilk's Lambda value of 0.773.

Perception was found to be the key in determining whether an innovation will be successfully diffused or the opposite. The authorities may view SmartCard as beneficial but the consumers may not. The result of this study showed that both adopters and non-adopter held different views with regard to SmartCard thus; appropriate promotion strategy is deemed desirable. It is also hoped that the findings in this study will bridge the gap between theoretical perspective and managerial perspective ending speculation that any university research offers little practical values.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi sebahagian keperluan untuk ijazah Master Sains

**KAD PINTAR SEBAGAI ALTERNATIF PEMBAYARAN:
PESPEKTIF PENYEBARAN INOVASI**

Oleh

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Jun 2002

Pengerusi: Prof. Madya Dr. Samsinar Md Sidin

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Tujuan utama kertas kerja ini adalah untuk menentukan persepsi masyarakat terhadap ciri-ciri inovasi dan memastikan samada ia berbeza di antara pengguna dan bukan pengguna kad pintar. Kad Pintar dipilih bagi kertas kerja ini kerana ia adalah inovasi yang terbaru dan penting untuk diselidik. Kerana ini jugalah keupayaan menginovasi dipilih sebagai salah satu tujuan utama kertas kerja ini. Keupayan menginovasi diukur oleh skala "Domain Specific Innovativeness" yang disarankan oleh Goldsmith dan Hofacker (1991) dan ciri-ciri inovasi pula diukur oleh skala yang dianjurkan oleh Rogers (1983).

Cronbach's Alpha menunjukkan nilai 0.7337 dengan statistic Kaiser-Meyer-Olkin bernilai 0.717. Di akhir kajian didapati, ANOVA menunjukkan pembolehubah demografik seperti bangsa dan umur memberi kesan ke atas keupayaan menginovasi.

Ini menunjukkan bahawa budaya, nasionalisma dan emosi memainkan peranan ke atas keupayaan menginovasi, jika dibandingkan dengan nilai-nilai yang lebih nyata. Perbezaan juga didapati di antara pengguna dan bukan pengguna kad pintar. Pengguna kad pintar didapati mempunyai lebih daya keupayaan menginovasi. Selain daripada itu, kajian ini juga menunjukkan bahawa persepsi terhadap ciri-ciri inovasi adalah ditentukan oleh keupayaan menginovasi seseorang.

Analisis diskriminan telah menunjukkan bahawa terdapat perbezaan nyata di dalam persepsi masyarakat terhadap ciri-ciri inovasi di antara pengguna dan bukan pengguna kad pintar.

Persepsi di dapati merupakan kunci di dalam menentukan samada satu inovasi itu akan berjaya atau pun tidak. Walaupun pihak berkuasa merasakan inovasi itu memberikan manfaat kepada pengguna, masyarakat tidak semestinya bersependapat. Kertas kerja ini telah menunjukkan perbezaan di antara pengguna dan bukan pengguna kad pintar. Ini menunjukkan bahawa promosi yang berbeza adalah perlu untuk menarik perhatian kedua kumpulan ini. Adalah diharapkan kertas kerja ini dapat mengurangkan jurang antara teori and praktik dan menamatkan spekulasi bahawa kertas kerja dari universiti tidak mempunyai nilai.

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Alhamdulillah, Alhamdulillah, Alhamdulillah

My heartfelt gratitude is due to Allah S.W.T., who has given me the strength to accomplish, the mind to contemplate, the will to persist, the health to endure and the spirit to prevail. This thesis will not suffice without His blessings.

This paperwork could not be accomplished alone. It is a result of many other contributions by individuals who have helped make this thesis a reality. It would be difficult, if not impossible for me to mention all of them here. However, there are some individuals in particular whom I would like to express my gratitude.

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I have tried my best in completing this study and any recognizable errors were corrected. It is with great hope that this study will be a beneficial one for all the parties mentioned above.

Thank You.

Tina Yusman


I certify that an Examination Committee met on 14th December 2001 to conduct the final examination of Graduate Student on her Master of Science thesis entitled "SmartCard as a Payment Alternative: A Diffusion of Innovation Perspective" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

A handwritten signature in black ink, appearing to read 'Tina', is written over a horizontal line.

Tina binti Yusman

Date: 1st June 2002

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CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter will assist the reader in the comprehension of the vital points in this study. It will also walk the reader through the derivation of the problem statement and how the research is to be undertaken. General objectives and specific objectives are also noted as a guideline for the study. This chapter also contained several explanations on what is SmartCard and how will SmartCard impact our daily lives.

1.1 SmartCard in Perspective

In the early days, bartering was a form of business transaction that occurred between two parties as a way of acquiring needs and wants. However, life got more complicated when the value of each commodity that was being exchanged is not befitting. This then gives rise to the first form of money-commodity, examples of which are cowry shell, cattle, sheep, salt, tobacco, iron, silver and gold. (*IT Malaysia, April 1996*)

The first form of money was found in China and the concept further developed with the earliest banker, merchants and goldsmith in Europe. This form of transaction has been in the commerce for many years. Credit cards made its appearance in 1960 as

the banking industry grew. By 1970, this “Plastic Money” has already become an important medium of exchange with the advancement of technology in that era.

Now, the next technology to reside on the plastic card is a microprocessor. This new card device is known as the SmartCard (IT Malaysia, April 1997). This so-called electronic cash or ‘e’-cash is now the new edge in the business that hypothetically will reduce the hassle of cash handling. With the advent of the SmartCard, we are heading towards the ever optimistic “Cashless Society” where a piece of card can buy us a product as small as roti canai to as big as a trip to Pulau Sipadan.

The Diffusion of Innovation generalizations, by Everett M. Rogers (1967, 1983), later revised by Rogers and Shoemaker (1971) will be used as the platform in this research. Diffusion is a concept that is intimately linked with the idea of innovation. The term comes from the Latin word meaning “to spread out”. Diffusion is exemplified by the way that gases or vapors slowly expand and spread through available space and has been defined simply as the process by which new ideas are communicated to members of a social system (Rogers & Shoemaker, 1971). This concept has also been explicitly defined from a sociological perspective by Katz et al (1963), as the acceptance, over time of some specific item, idea or practice by individuals, groups or other adopting units, linked to specific channels of communication, to a social structure and to a given system of values or culture.

In this research, the author will attempt to test the significance of innovation characteristics that are found in the diffusion of innovation literature. According to Tornatzky and Klein (1982), it is possible to arrive at some generalization on the relationship between a few innovation characteristics and adoption/diffusion. They have found, that out of the twenty-five innovation characteristics that were evaluated by prior studies, ten were most frequently studied by researcher. These ten are compatibility, relative advantage, complexity, costs, communicability, divisibility, profitability, social approval, triability and observability. Summarizing from these previous researches, Rogers and Shoemaker (1971) has constructed a typology depicting the characteristics by which a potential adopter evaluates an innovation. Those characteristics are relative advantage, compatibility, complexity, triability and observability.

This study will test the perception of two major groups, adopter and non-adopter towards the perceived significance of the Rogers and Shoemaker's typology on innovation characteristics. On top of that, this study will also test the innovativeness of the groups and how this innovativeness will affect the perceived significance of the innovation characteristics. It is rather imperative for a research of this sort to be carried out due to the fact that it is rather scarce. While studies using the adoption perspective evaluate the characteristics of an organization or society that make it receptive to innovation and change, studies using the diffusion perspective attempt to understand why and how an innovation spreads and what characteristics of the

innovation lead to widespread acceptance (Premkumar and Ramamurthy, (1994). Studying the process of diffusion of the innovation is as critical as the studies of the adoption process, but most studies have focused only in adoption process (Tornatzky and Klein, 1982).

It is rather a conflicting subject matter due to the reason that, past researches have demonstrated that their perceived characteristics of an innovation are closely linked to adoption (e.g. Gatignon and Robertson, 1985; Moore and Benbasat, 1991; Rogers, 1995). Barnett (1953, p.313) was one of the first to propose that “the character of a new idea itself is an important determinant of the nature of the reception to the idea”. According to Ostlund (1974), for example, the perception of innovations by potential adopters can be very effective predictors of innovativeness, more so than personal characteristics variables. Similarly, Labay and Kinner (1981) also found that individual perceptions of an innovation provided a better prediction adoption behavior than did demographic variables.

Therefore, it is rather perplexing why there have been bulks of research regarding consumer characteristics but a rather limited research has empirically considered the role of innovation characteristics within the marketing literature (Dickerson and Gentry, 1983; Goslar 1987; LaBay and Kinnear 1983; Ostlund 1972; 1974).

Another aspect that will be considered in this study is innovativeness. Diffusion and innovativeness goes hand in hand. Innovativeness could be expressed by the degree to which a person is relatively earlier in adopting an innovation than other members of his or social system (Rogers, 1985). Rogers indicated that the perceived newness of the idea for the individual determines his or her reaction to it. Furthermore, Haines (1966) found that 25 percent of those trying a product for the first time reported that they had bought the product “because it was new”. This lend support to the idea that the diffusion process gets started by innovative people and consequently lend support to the idea that newness is desirable for itself, at least to some people.

SmartCard is coming. The question is, will they stay? One of the seven(7) Flagship of the Malaysia’s Multimedia Super Corridor is to realize the dream of Cashless society (IT, Malaysia, Techno-edge, April 1996). This multipurpose card not only will replace cash, but also the present identification card, passport, medical history and many more, all integrated in one card. How ready is the society in accepting this? Therefore, it is imperative for the authorities to fully understand how the society reacts to this change in order for this innovation to strive.

1.2 SmartCard

What exactly is SmartCard? David Tebbutt in the Director (1997) clarified that SmartCard are actually miniature computers. Each contains its own processor,

operating systems, application and memory that give them the advantage over the more common memory cards. Another denotation of SmartCard was also done by Worthington (1995) as a payment card that carries an embedded computer chip with memory and interactive capabilities, with non-programmable logic that allow it to exchange data at an electronic point of service (POS) terminals. SmartCard technology was developed over 20 years ago but its low acceptance into mainstream market has been blamed upon a lack of supporting infrastructure and universally accepted standards. However, there is little doubt that SmartCard has huge potential in terms of its application and recent evidence seems to show that predicted growth rates will continue as more application of SmartCard technology to electronic commerce is realized.

The SmartCard method of payment involves a card embedded with either a microprocessor with internal memory or a memory chip with non-programmable logic. The chip connection works with an anonymous user either via direct physical or remotely via a contactless electromagnetic surface.

There are three(3) categories of SmartCard available today:

Integrated circuit microprocessor card, also referred to as “chip cards”, are known as miniature computers and contain memory and a processor with data-processing capabilities. The data processing power can be used to encrypt or decrypt of chip

cards. It has an eight bit processor read-only memory and 512 bytes of random-access memory.

Integrated circuit memory card can be viewed as minuscule removable read/write disks with optional security. It has no processor on the card with which to manipulate data. It is in this way, dependent on the card reader for its processing.

Optical memory card looks like a card with a piece of CD in top. Once written, the data cannot be changed. This card is ideal for keeping records such as medical files.

1.2.1 Capability of SmartCard

The SmartCard generic function includes, data protection against unauthorized access code, identification of the cardholder or device which is capable of validating the pin and storing the card-reader identification in the logfile and mutual authentication for both parties whereby merchant-buyer will attest to the transaction. Another important function for SmartCard would be the secure writing whereby a log keeps tract of background information on each transaction.

SmartCard also functions as certification or signature for the pin will serve as proof of certification or signature, as encryption whereby it will allow validation of PIC and identification for card-reader.

Among the application, the three most common kinds are the *data carrier* where the card is a convenient, portable and secure way to store data, the *conditional access for security* whereby the card ensures that only authorized people enter or use a site, computer, software package or service. Besides those two, the card also replaces credit cards, chequebooks and cash. In an interview with Dr. Wong Swee Min from Scandata Sdn Bhd in 1999, he stated that a SmartCard could very well reduce twenty-four (24) applications into four (4), which are payment systems, portable file and records, access control and network data security.

The SmartCard technology has security features that will prevent the SmartCard from abuse. A SmartCard is extremely difficult to forge and the cost for doing so is simply too high to make the effort pay. At Bank Islam (in IT Malaysia, 1996), holders of the bank SmartCard need not monitor their transaction because the card is very intelligent. The security of an account is in the hands of the bank account holder and is not dependent on the host computer.

1.2.2 Functions of SmartCard

In some developed countries, SmartCard is used as a substitute for cash. In others, it acts as a ubiquitous for identification (in the Director, 1997). It is used to store information in a more convenient way than passport, insurance policy or a car